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**IDENTIFIER:**  
**TITLE:** LAMINATED MULTI-LAYER WINDOW STRUCTURE FOR VEHICLE  
  
**PUBN-DATE:** July 17, 2001

**INVENTOR- INFORMATION:**

NAME	COUNTRY
FUNADOKORO, KATSUYUKI	N/A
MUROMACHI, TAKASHI	N/A
HASHIMOTO, SOICHIRO	N/A

**ASSIGNEE- INFORMATION:**

NAME	COUNTRY
NIPPON SHEET GLASS CO LTD	N/A
TSUTSUNAKA PLAST IND CO LTD	N/A

**APPL-NO:** JP2000002102

**APPL-DATE:** January 11, 2000

**INT-CL (IPC):** C03C027/06 , B32B017/10 , B60J001/00 , B61D025/00

**ABSTRACT:**

**PROBLEM TO BE SOLVED:** To provide a multi-layer window structure using the laminated glass reduced in warpage in a laminated multi-layer window structure for the railway vehicle.

**SOLUTION:** This laminated multi-layer window structure for vehicle is composed of a polycarbonate board, an urethane film, a first inorganic glass plate, an air layer and a second inorganic glass plate from the outside of the vehicle. In this case, the thickness of the polycarbonate board is controlled to  $\leq 2.5$  mm, and the thickness of the first inorganic glass plate is adjusted to  $\geq 3$  to  $\leq 5$  mm. Meanwhile, the second inorganic glass plate is of thermally strengthened glass, and the thickness is controlled to  $\geq 4$  to  $\leq 6$  mm.

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WEEK:

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**TITLE:** Alignment multilayer window structure for vehicles such as train, comprises polycarbonate board, urethane film, first inorganic glass plate, air space, and second inorganic glass plate made of hot tempered glass

**INVENTOR:** FUNADOKORO K; HASHIMOTO S ; MUROMACHI T

**PATENT-** NIPPON SHEET GLASS CO LTD[NIPG] , TSUTSUNAKA PLASTIC  
**ASSIGNEE:** IND CO LTD[TSUTN]

**PRIORITY-DATA:** 2000JP-002102 (January 11, 2000)

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PUB-NO	PUB-DATE	LANGUAGE
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**APPLICATION-DATA:**

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JP2001192242A	N/A	2000JP-002102	January 11, 2000

**INT-CL-**

**CURRENT:**

TYPE	IPC	DATE
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CIPS	<u>B32</u> <u>B</u> <u>17/10</u>	20060101
CIPS	<u>B60</u> <u>J</u> <u>1/00</u>	20060101
CIPS	<u>C03</u> <u>C</u> <u>27/06</u>	20060101

**ABSTRACTED-PUB-NO:** JP 2001192242 A

**BASIC-ABSTRACT:**

NOVELTY - The alignment multilayer window structure (1) comprises a polycarbonate board of thickness 2.5 mm or less, an urethane film (3)

of thickness 0.5-1 mm, an inorganic glass plate (I) (4) of thickness of 3-5 mm, an air space (5), and an inorganic glass plate (II) (6) of thickness 4-7 mm. The inorganic glass plate (II) is made of hot tempered glass.

**DESCRIPTION** - A hard-coat layer (21) is provided to the surface of polycarbonate board, and a primer layer is provided between the inorganic glass plate (I), and the urethane film.

**USE** - For vehicles (claimed) such as trains.

**ADVANTAGE** - The inexpensive alignment multilayer window structure has minimized curvature, excellent thermal insulation, and excellent sound insulation property. Damage of window structure is prevented, since hard-coat layer is provided to the surface of polycarbonate board. The multilayer window structure excels in adhesion, since a primer layer is provided between the inorganic glass plate (I), and the urethane film.

**DESCRIPTION OF DRAWING(S)** - The figure shows the fragmentary sectional view of alignment multilayer window structure.

Alignment multilayer window structure (1)

Polycarbonate board (2)

Urethane film (3)

Inorganic glass plate (4,6)

Air space (5)

Hard-coat layer (21)

**CHOSEN-** Dwg.1/2

**DRAWING:**

**TITLE-** ALIGN MULTILAYER WINDOW STRUCTURE VEHICLE TRAIN COMPRISE  
**TERMS:** POLYCARBONATE BOARD URETHANE FILM FIRST INORGANIC GLASS  
PLATE AIR SPACE SECOND MADE HOT TEMPER

**DERWENT-CLASS:** A95 L01 P73 Q12 Q21

**CPI-CODES:** A05-E06B; A05-G01E; A12-T04A; L01-H05; L01-L02;

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K9701 K9676; B9999 B5243\*R B4740; B9999 B5549 B5505;  
B9999 B3974\*R B3963 B3930 B3838 B3747;

Polymer Index [1.3] 018 ; B9999 B5414\*R B5403 B5276;  
K9483\*R;

Polymer Index [2.1] 018 ; P1592\*R F77 D01; S9999  
S1285\*R;

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Q9234 Q9212; Q9999 Q9289 Q9212; K9574 K9483; K9676\*R;  
K9701 K9676; B9999 B5243\*R B4740; B9999 B5549 B5505;  
B9999 B3974\*R B3963 B3930 B3838 B3747;

Polymer Index [2.3] 018 ; K9529 K9483;

**SECONDARY-ACC-NO:**

CPI Secondary Accession Numbers: 2001-189927

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## \* NOTICES \*

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

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## CLAIMS

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### [Claim(s)]

[Claim 1]It is the doubling double glazing window structure for vehicles which comprises a vehicle outside with a polycarbonate board / urethane membrane / the 1st inorganic glass board / air layer / the 2nd inorganic glass board, Doubling double glazing window structure for vehicles, wherein the thickness of said polycarbonate board is 2.5 mm or less, the thickness of said 1st inorganic glass board is not less than 3 mm 5 mm or less, said 2nd inorganic glass board is heat tempered glass and the thickness is not less than 4 mm 7 mm or less.

[Claim 2]Doubling double glazing window structure for vehicles where a hard court layer is provided in the surface in the doubling double glazing window structure for vehicles according to claim 1 as for said polycarbonate board.

[Claim 3]Doubling double glazing window structure for vehicles where a primer layer is provided between said 1st inorganic glass board and said urethane membrane in the doubling double glazing window structure for vehicles according to claim 1.

[Claim 4]Doubling double glazing window structure for vehicles where thickness of said urethane membrane is 0.5-1.0 mm in the doubling double glazing window structure for vehicles according to claim 1.

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[Translation done.]

## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the doubling double glazing window structure for vehicles. In particular, it is related with a doubling double glazing window structure for vehicles suitable at high speed for the rapid transit railway vehicles it can run.

[0002]

[Description of the Prior Art] In the rail car which carries out high speed operation, with the wind pressure at the time of a run, the ballast (gravel stone) on a track can wind up and vehicles may be collided with. Hereafter, this is called a "stepping stone." When this stepping stone collides with the window of vehicles and a windowpane is damaged, it will interfere also with operation of trains.

[0003] Furthermore, the windowpane of a rail car has various demands. For example, adiathermancy and insulation are searched for for the amenity. The weight saving is called for for improvement in high speed running performance.

[0004] Then, the problem of a crack is solvable by making a windowpane into the glass laminate structure of inorganic glass and resin glass, and making resin glass into a vehicle exterior as a measure against a stepping stone. Although the surface of resin glass has the problem of being easy to attach a crack, it is solvable by giving a hard court to the surface.

[0005] In order to raise adiathermancy and insulation, it is possible to consider it as multiple glass.

[0006] For example, in the window structure for rail cars, using a glass laminate or multiple glass is shown by JP,7-232640,A in the windowpane. The multiple glass which used the glass laminate is especially shown by the 14th example. That is, it is doubling multiple glass which is a surface treatment / resin sheet / glue line / glass / air layer / inside transparent member (side in the car), and comprises a vehicle exterior.

[0007] To JP,11-58612,A, in drawing 2, a hard court (8 micrometers) / polycarbonate (3-mm thickness) / primer (0.5-micrometer thickness) / glue line / primer (0.5-micrometer thickness) / glass plate (3-mm thickness) / air layer (6-mm thickness) / glass plate (5-mm thickness), The doubling multiple glass which becomes more is shown.

[0008]

[Problem(s) to be Solved by the Invention] The concrete thickness of each component is not shown by the window structure indicated in the 14th example of above-mentioned JP,7-232640,A.

[0009] Adhesives are poured in and it is made to unify in the doubling multiple glass indicated by above-mentioned JP,11-58612,A between polycarbonate and the glass plate by which

priming was carried out. However, as for this method, there was a problem in endurance, and it was difficult to put in practical use.

[0010]When this invention person set polycarbonate (3-mm thickness) and an inorganic glass board (3-mm thickness) using urethane membrane, this different-species glass laminate had large curvature, and was still more difficult to consider it as multiple glass.

[0011]This invention is made in view of the above situations. As the concrete issue which should be solved, there is curvature in providing the double glazing window structure using few different-species glass laminates in the doubling double glazing window structure for the vehicles for railroads. It is in providing doubling double glazing window structure with being divided [ little ] also to a wind pressure.

[0012]

[Means for Solving the Problem]In order to solve a technical problem mentioned above, this invention as the invention according to claim 1, It is the doubling double glazing window structure for vehicles which comprises a vehicle outside with a polycarbonate board / urethane membrane / the 1st inorganic glass board / air layer / the 2nd inorganic glass board, It is the doubling double glazing window structure for vehicles, wherein the thickness of said polycarbonate board is 2.5 mm or less, the thickness of said 1st inorganic glass board is not less than 3 mm 5 mm or less, said 2nd inorganic glass board is heat tempered glass and the thickness is not less than 4 mm 7 mm or less.

[0013]In the doubling double glazing window structure for vehicles according to claim 1, said polycarbonate board is the doubling double glazing window structure for vehicles where a hard court layer is provided in the surface.

[0014]In the doubling double glazing window structure for vehicles according to claim 1, it is the doubling double glazing window structure for vehicles where a primer layer is provided between said 1st inorganic glass board and said urethane membrane.

[0015]In the doubling double glazing window structure for vehicles according to claim 1, thickness of said urethane membrane is the doubling double glazing window structure for vehicles which is 0.5-1.0 mm.

[0016]As for doubling double glazing window structure for vehicles by this invention, in above-mentioned composition, the thickness of said polycarbonate board is 2.5 mm or less, The thickness of said 1st inorganic glass board is not less than 3 mm 5 mm or less, said 2nd inorganic glass board is heat tempered glass, and the thickness is setting it to not less than 4 mm 6 mm or less.

[0017]Below, a reason for limitation of thickness of a component is explained.

- Polycarbonate : a polycarbonate board is setting the thickness to 2.5 mm or less. When thicker than 2.5 mm and it is considered as a glass plate and a glass laminate via urethane membrane, curvature will become large too much according to a difference of an expansion

coefficient. It is not limited in particular for a minimum of thickness of a polycarbonate board. What is necessary is just to have the thickness which can protect with [ by a stepping stone ] a crack. Specifically, 0.5 mm or more is preferred.

[0018]- The 1st inorganic glass board : the thickness is setting the 1st inorganic glass board to not less than 3 mm 5 mm or less. When the 1st inorganic glass board was thinner than 3 mm and it is considered as a glass plate and a glass laminate via urethane membrane, curvature will become large too much. Furthermore by curvature, there is awe which glass damages. When the 1st inorganic glass board was thicker than 5 mm and a wind pressure etc. act, a pressure to share becomes large and stress generated to the 1st inorganic glass board also becomes large. For this reason, awe which the 1st inorganic glass board damages comes out. Weight will also increase.

[0019]- The 2nd inorganic glass board : the thickness is setting the 2nd inorganic glass board to not less than 4 mm 7 mm or less. When the 2nd inorganic glass board was thinner than 4 mm and a wind pressure etc. act, stress generated to the 1st inorganic glass board also becomes large due to a pressure to share. For this reason, awe which the 1st inorganic glass board damages comes out. If the 2nd inorganic glass board exceeds 7 mm, weight increase will become large and will carry out.

[0020]In composition of claim 1, it is still more preferred that thickness of said urethane membrane is 0.5-1.0 mm. A buffer effect of curvature when a dissimilar material which urethane membrane has as this thickness is less than 0.5 mm is doubled is not acquired enough. Since buffer effect sufficient at about 1.0 mm is acquired, this thickness is not preferred only by a material cost increasing, even if this thickness exceeds 1.0 mm.

[0021]

[Embodiment of the Invention]This invention is explained in detail, referring to drawings below. Drawing 1 is a fragmentary sectional view of the doubling double glazing window structure for vehicles by this invention.

[0022]The doubling double glazing window structure for vehicles by this invention is manufactured at the following processes.

(1) First, as for a polycarbonate board, after accepting the thing of a prescribed dimension as glass laminate \*\*\*\*\*, it carries out washing desiccation, it carries out corona discharge treatment of the surface which turns into the adhesion side further, and raises an adhesive property. Next, washing desiccation of the 1st inorganic glass board cut by the predetermined size is carried out. Via the urethane membrane of a prescribed dimension, said polycarbonate board and a glass plate are made to match, and it is considered as a glass laminate. It is good for the surface used as the adhesion side of the 1st inorganic glass board to apply an aminosilane system primer and to raise an adhesive property.

[0023]Then, the glass laminate made to match is pasted up in the following procedures. First,

the matched glass laminate is put in in a vacuum bag. This vacuum bag is put into autoclave. The inside of a vacuum bag is made into the number mTorr - the vacuum of tens mTorr(s) at this time. The inside of autoclave is heated at 90-100 \*\*. When the temperature in autoclave reaches about 80 \*\*, ACV internal pressure is pressurized at 6 - 7 kg/cm<sup>2</sup>. The state where above-mentioned application-of-pressure heating was carried out is held for 10 to 30 minutes. After maintenance carries out atmospheric pressure release of the pressure, and cools it naturally to a room temperature. The inside of a vacuum bag is a vacua till the above-mentioned end of maintenance.

[0024](2) Prepare the 2nd inorganic glass board which was first produced by the glass laminate prepared at (1) process, and the well-known method and by which thermal tempering by air jets was carried out as multiple glass \*\*\*\*\*. Doubling multiple glass is manufactured by the manufacturing method of well-known multiple glass using these.

[0025](Examples 1-6) The composition of an example is shown below. A windowpane size is 640x750 mm.

- polycarbonate board: -- the Tsutsunaka Plastic Industry make and made in - urethane membrane:Morton with a hard court ;P E399 and 1st inorganic glass board: -- green glass and air layer: by a float glass process -- 6-mm and 2nd inorganic glass board: -- it is thermal-tempering-by-air-jets glass -- the thickness of each component of each example is shown in Table 1.

[0026]

[Table 1]

example	PORIKA / urethane	-- the 1st	-- glass/air layer	-- the 2nd	glass	curvature	Wind pressure (mm)	(mm)	(mm)	(mm)	(mm)	(mm)	Examination																																																																				
-----	-----	1	0.5	/	0.5	/	3.0	/	6.0	/	4.0	0.5	-	1.0	O	2	0.5	/	5.0	/	6.0	/	4.0	1.0	-	2.0	O	3	2.0	/	0.5	/	4.0	/	6.0	/	5.0	2.0	to	3.0	O4	2.0	/	0.5	/	5.0	/	6.0	/	4.0	0.5	to	1.0	O5	0.5	/	1.0	/	5.0	/	6.0	/	4.0	0.5	to	1.0	O6	0.5	/	3.0	/	6.0	/	6.0	0.5	-	1.0	O	-----	[0027]	The curvature

(after-mentioned) as multiple glass is about 4 mm at the maximum, and was able to constitute the double glazing window from doubling double glazing window structure for vehicles of these examples. A wind-pressure examination (after-mentioned) was not damaged, either. The result is also doubled and it is shown in Table 1. It expresses that "x" damaged not damaging "O" with the column of a wind-pressure examination. However, the curvature of glass is defined as d (however, the long side side of glass) in drawing 2.

[0028]The wind-pressure examination was carried out as follows. The pressure test machine which can supply positive pressure and negative pressure was used for the container which will be in a sealed state by setting the glass plate used as a sample. Positive pressure and negative pressure were supplied by turns so that it might be set to \*\*1000mmAq, in about 7 seconds, the pressure in a container considered it as one cycle, carried out 100 cycle load,

and the endurance to a wind pressure was examined.

[0029]When the doubling double glazing window structure for vehicles of the example shown above collided a pebble 2 g in weight at right angles to a glass surface at 90 km/h, the crack was produced in neither of the window structures. Since it was considered as double glazing window structure, it excelled also in adiathermancy or insulation.

[0030]In the above example, although only the 2nd inorganic glass board was used as heat tempered glass, the 1st inorganic glass board is also good also as heat tempered glass.

[0031](Comparative examples 1-5) Table 2 is shown for the example mentioned above and the comparative example whose thickness of each component is outside the range of the claim of this invention with the same composition.

[0032]

[Table 2]

comparative example	PORIKA / urethane	-- the 1st	-- glass/air layer	/ -- the 2nd	glass curvature	Wind pressure (mm)	(mm)	(mm)	(mm)	(mm)	(mm)	Examination
		1	0.3 / 0.5 / 3.0 / 6.0 / 4.0	0.5 - 1.0 x	2	3.0 / 0.5 / 3.0 / 6.0 / 4.0	0.5 - 1.0 x	2	3.0 / 0.5 / 3.0 / 6.0 / 4.0	0.5 - 1.0 x	2	3.0 / 0.5 / 3.0 / 6.0 / 4.0

[0033]From the comparative examples 2 and 3, the curvature of the glass laminate was too large to constitute a doubling double glazing window.

[0034]Although the doubling double glazing window was able to be constituted from the comparative examples 1, 4, and 5, each has been damaged by the wind-pressure examination.

[0035]

[Effect of the Invention]As explained above, since the invention according to claim 1 set thickness of the polycarbonate board to 2.5 mm or less and set thickness of the 1st inorganic glass board to not less than 3 mm 5 mm or less first as a doubling double glazing window structure, it is taken as the glass laminate with little curvature. For this reason, it is possible to constitute the double glazing window using a glass laminate.

[0036]The thickness of 5 mm or less and the 2nd inorganic glass board is setting thickness of the 1st inorganic glass board to not less than 4 mm. For this reason, when a wind pressure etc. act, the pressure which the 1st inorganic glass board shares does not become large, and there is no awe which the 1st inorganic glass board damages.

[0037]Since the thickness of the 1st glass plate was furthermore 5 mm or less and the thickness of the 2nd inorganic glass board was 6 mm or less, the weight increase more than needed can be prevented.

[0038]Since it is considered as doubling double glazing window structure which was mentioned above, it excels also in adiathermancy or insulation.

[0039]In the invention of claim 2, since the hard coat layer was provided on the surface of the polycarbonate board in addition to the doubling double glazing window structure for vehicles of claim 1, it has structure which a crack cannot attach easily.

[0040]In the invention of claim 3, since the primer layer was provided between the 1st inorganic glass board and urethane membrane in addition to the doubling double glazing window structure for vehicles of claim 1, an adhesive property improves further.

[0041]In the invention of claim 4, since the thickness of said urethane membrane was 0.5-1.0 mm in addition to the doubling double glazing window structure for vehicles of claim 1, curvature of a different-species glass laminate can be made small enough, and, moreover, it is low cost.

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[Translation done.]